

Seminar

Wednesday, October 4, 2017

11:00 AM – 206 Furnas Hall

Jingguang Chen

Thayer Lindsley Professor

Chemical Engineering - Columbia University

Converting CO₂ via Thermocatalysis and Electrocatalysis

Rising atmospheric concentration of CO₂ is forecasted to have potentially disastrous effects on the environment from its role in global warming and ocean acidification. Converting CO₂ into valuable chemicals and fuels is one of the most practical routes for reducing CO₂ emissions while fossil fuels continue to dominate the energy sector. The catalytic reduction of CO₂ by H₂ can lead to the formation of three types of products: CO through the reverse water-gas shift (RWGS) reaction, methanol via selective hydrogenation, and methane by the methanation pathway. In the current talk we will first describe our efforts in controlling the catalytic selectivity for the three products using a combination of DFT calculations and surface science studies over single crystal surfaces, catalytic evaluation of supported catalysts, and in-situ characterization under reaction conditions. Next, we will discuss our efforts in converting CO₂ without using H₂. This is motivated by the fact that ~95% of H₂ is generated from hydrocarbon-based feedstocks, producing CO₂ as a byproduct. We will present two approaches to avoid using H₂ for CO₂ conversion. The first approach involves the utilization of light alkanes, such as ethane, to directly reduce CO₂ via the dry reforming pathway to produce synthesis gas ($C_2H_6 + 2CO_2 \rightarrow 4CO + 3H_2$) and the oxidative dehydrogenation route to generate ethylene ($C_2H_6 + CO_2 \rightarrow C_2H_4 + CO + H_2O$). The second approach is the electrolysis of CO₂ to produce synthesis gas with controlled CO/H₂ ratios. We will conclude our presentation by providing a perspective on the challenges and opportunities in converting CO₂ via various routes in thermocatalysis and electrocatalysis.

Refreshments at 10:45



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